



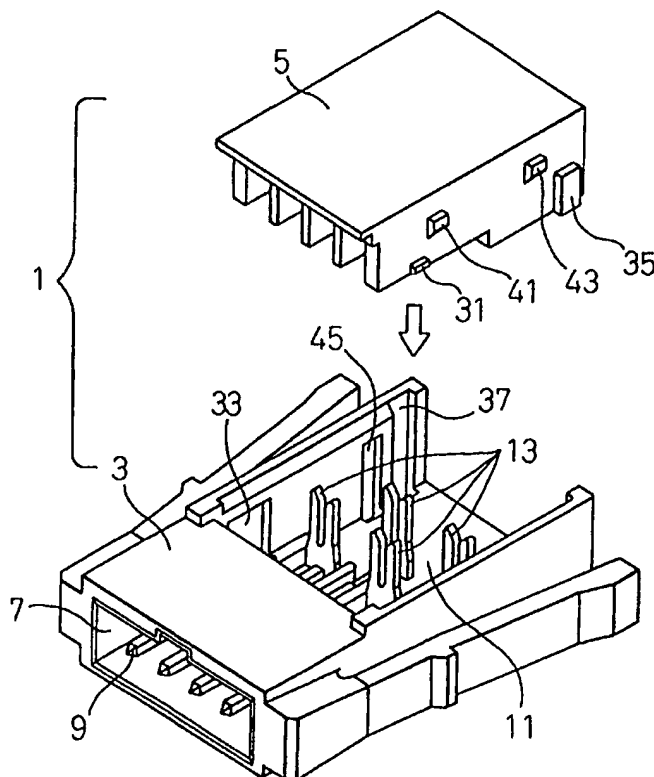
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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| (51) International Patent Classification ⁶ : H01R 4/24 | A1 | (11) International Publication Number: WO 99/66598 (43) International Publication Date: 23 December 1999 (23.12.99) |
| (21) International Application Number: PCT/US99/11535 (22) International Filing Date: 25 May 1999 (25.05.99) (30) Priority Data: 10/166929 15 June 1998 (15.06.98) JP (71) Applicant (for all designated States except US): MINNESOTA MINING AND MANUFACTURING COMPANY [US/US]; 3M Center, P.O. Box 33427, Saint Paul, MN 55133-3427 (US). (72) Inventors; and (75) Inventors/Applicants (for US only): FUKUSHI, Makoto [JP/JP]; 3-16-15-203, Fuchinobe-Honcho, Sagami-hara-city, Kanagawa pref. 229-0002 (JP). MATSUOKA, Hiroyuki [JP/JP]; 6-9-103, Kyowa 1-chome, Sagami-hara-city, Kanagawa pref. 229-0034 (JP). SHIMADA, Masashi [JP/JP]; 1-1, Morinosato 2-chome, Atsugi-city, Kanagawa pref. 243-0122 (JP). (74) Agents: MCNUTT, Matthew, B. et al.; 3M Innovative Properties Company, Office of Intellectual Property Counsel, P.O. Box 33427, Saint Paul, MN 55133-3427 (US). | | (81) Designated States: CA, CN, KR, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> |

(54) Title: PRESSURE WELDING CONNECTION TYPE CONNECTOR AND PRESSURE WELDING METHOD THEREFOR

(57) Abstract

To provide an insulation displacement connection type connector wherein cable insertion can be made easier and more speedy and therefore reliable connection can be realized. A terminal block (3) for housing therein a plurality of terminals (9) to which cables are insulation displaced for electric conduction; an insulation displacement block (5) having cable insertion holes (15) for inserting cables, the insulation displacement block being adapted to be set in a state parallel to the terminal block (3) at a time of insulation displacement of cables and to be moved, as it is, close to the terminal block (3), in a translational movement manner; inclination holding means (31, 33, 35, etc.) for releasably holding the insulation displacement block (5) in a state inclined relative to the terminal block (3), to thereby facilitate insertion of the cables; and parallelism holding means (41, 43, etc.) for releasably holding, upon release of holding, the insulation displacement block (5) in a state parallel to the terminal block (3), are included.



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PRESSURE WELDING CONNECTION TYPE CONNECTOR AND
PRESSURE WELDING METHOD THEREFOR

5 DETAILED DESCRIPTION OF THE INVENTION

Technical Field of the Invention

The present invention relates to an insulation
displacement connection type connector for electrical
10 insulation displacement connection of cables (wires,
leads, etc.) inserted into an insulation displacement
block with insulation displacement portions of
terminals housed in a terminal block, and also relates
to an insulation displacement process (or procedure)
15 thereof.

Prior Art and Problems to be Solved by the Invention

There have been conventionally proposed a variety
of structures of insulation displacement connection
20 type connectors. For example, in KOKAI (Japanese
Unexamined Patent Publication) No. 9-35771 or KOKAI
(Japanese Unexamined Utility Model Publication) No. 3-
68362, there is disclosed a connector of a type wherein
an insulation displacement block and a terminal block
25 are formed integrally, and opened and closed through a
hinge portion. In the case of this structure, cables
can be readily inserted, since the insulation
displacement block is in an inclined position relative
to the terminal block.

30 However, the structure is such that insulation
displacement is initiated in a situation where the
insulation displacement parts of terminals are still
inclined relative to the cables, and the insulation
displacement parts of terminals become perpendicular to

the cables upon completion of the insulation displacement, with the drawback that the core wires of the cables are likely to be damaged.

To eliminate this drawback, KOKAI (Japanese Unexamined Utility Model Publication) No. 6-88054 has proposed a structure wherein a pressure welding block and a terminal block are formed by separate members, respectively, and the pressure welding block can be held in a position parallel to the terminal block prior to pressure welding.

Unfortunately, in this case, the parallelism between the terminal block and pressure welding block conversely functions to render cable insertion relatively difficult, which is a significant drawback.

It is therefore an object of the present invention to provide an insulation displacement connection type connector which is rational and economical in that it has the advantages of the aforementioned two types of connectors, while simultaneously eliminating their drawbacks, to thereby drastically reduce the burden of assembling them.

Means for Solving the Problems

To solve the above problems, the present invention provides an insulation displacement connection type connector, including: a terminal block for housing therein a plurality of terminals to which cables are insulation displaced for electric conduction; an insulation displacement block having cable insertion holes for inserting cables, said insulation displacement block being adapted to be set in a state parallel to said terminal block at a time of insulation displacement of cables and to be moved, as it is, close

to said terminal block, in a translational movement manner; inclination holding means for releasably holding said insulation displacement block in a state inclined relative to said terminal block, to thereby
5 facilitate insertion of said cables; and parallelism holding means for releasably holding, upon releasing of said holding, said insulation displacement block in a state parallel to said terminal block.

The present invention also provides a method for
10 insulation displacement in an insulation displacement connection type connector, including: a terminal block for housing therein a plurality of terminals to which cables are insulation displaced for electric conduction; and an insulation displacement block having
15 cable insertion holes for inserting cables, the insulation displacement block being adapted to be set in a state parallel to the terminal block at a time of insulation displacement of cables and to be moved, as it is, close to the terminal block, in a translational
20 movement manner; comprising the steps of: holding the insulation displacement block in a state inclined relative to the terminal block, making use of inclination holding means; inserting cables into cable insertion holes of the insulation displacement block;
25 holding the insulation displacement block in a state parallel to the terminal block, making use of parallelism holding means; and conducting an insulation displacement operation by moving the insulation displacement block relatively close to the terminal
30 block, in a translational movement manner.

Mode for Carrying Out the Invention

Embodiments of the present invention will be

described below with reference to the drawings.

Figs. 1 to 3 show respectively a plan view, a left side view and a right side view of an embodiment of an insulation displacement connection type connector according to the present invention. A connector 1 shown in the drawings is basically composed of two separate members, i.e., a terminal block 3 which constitutes a main body of the connector 1 and an insulation displacement block 5 detachably attached to the terminal block 3.

The terminal block 3 is molded of polyamide resin (nylon 6, nylon 66, etc.), PBT (polybutylene terephthalate), or PCT (polychlorinated triphenyl), etc. by injection molding.

The insulation displacement block 5 is molded of, for example, transparent PC (polycarbonate) by injection molding, so that cables can be seen therethrough upon insulation displacement connection. Additionally, a transparent material or opaque (translucent) material, for example, PP, polyamide resin, PET (polyethylene terephthalate), etc., can be used.

On one side (left side in Fig. 1) of the terminal block 3 (connector 1), is provided a box-shaped recess 7 in which a plurality of terminals 9 (4 terminals in the illustrated embodiment) are provided and secured at a predetermined space (shown in Fig. 2) to be connected to corresponding connectors (not shown).

A largely cut away recess 11 is provided on the other side (right side in Figs. 1 and 4) of the terminal block 3. The recess 11 defines a portion to which the insulation displacement block 5 is detachably attached.

On the bottom surface of a recess 11 of the terminal block 3, terminals 9 are arranged and secured in parallel, with raised root portions being upwardly bent by a predetermined length.

5 The raised portion of each terminal 9 is in the form of a fork (or U-shape) i.e., is shaped in a so-called insulation displacement form. The (bifurcated) insulation displacement portions 13 of the terminals function to cut outer sheaths of cables (assuming that
10 the cables are individually separated cables in the illustrated embodiment) to directly establish and keep the electrical connection to the cables.

 The raised portions of the terminals 9 are staggered considering the space utilization efficiency.
15 Namely, if the raised portions were laterally arranged along a line, the lateral size of the connector could be too small to accommodate all the raised portions.

 The insulation displacement block 5 mounted to the recess 11 of the terminal block 3, as shown in Fig. 5
20 which shows a single insulation displacement block 5, is provided on its rear surface with cables inserting circular through holes 15 which are regularly arranged in parallel, and whose number corresponds to that of the terminals 9 (i.e., 4 through holes in the
25 illustrated embodiment). The circular holes 15 are connected to each other at the lower portions thereof on the inlet side.

 As shown in Figs. 6 and 7, a cable engaging member (engaging mean) 21 for temporarily holding the cables
30 inserted in the circular holes 15 to prevent the cables from being disengaged therefrom is mounted to the connecting portion of the circular holes 15.

 The cable engaging member 21 can be integrally

formed with the insulation displacement block, but is formed as a separate piece (part) in the illustrated example, and is, for example, molded of the same material as the aforementioned terminal block 3 by injection molding. As shown in Fig. 8, the cable engaging member 21 is provided with elastically deformable abutments 21b which extend obliquely from base portions 21a in the form of a cantilever. The number of the abutments 21b corresponds to that of the circular holes 15 (i.e., four).

Each of the abutments 21b extends in the corresponding circular hole when the cable engaging member 21 is mounted to the insulation displacement block 5 (Fig. 7).

Projections 21c are provided on the lower surface portion of the cable engaging member 21. The projections 21c are engaged in corresponding recesses 25 provided in the insulation displacement block 5 to prevent the cable engaging member 21 from being easily detached therefrom.

In the circular hole 15 of the insulation displacement block 5 are formed recesses (four recesses) 27 in which the (four) raised (bifurcated) insulation displacement portions 13 (in the zigzag arrangement) of the terminals 9 can be inserted upon insulation displacement operation.

The insulation displacement block 5 is provided on each of the opposed side faces thereof with four projections. The first front and lower projections 31 (on the terminal block connector connection side) are loosely engaged in larger rectangular first recesses 33 provided on the inner side faces (of both sides) of the terminal block 3 when the insulation displacement block

5 is mounted to the terminal block 3, namely, the loose engagement permits the first projections and the first recesses to relatively move to some extent. Thus, the engagement portions define a hinge portion at which the insulation displacement block 5 can move relative to the terminal block 3.

The second rear and lower projections 35 provided on both side faces of the insulation displacement block 5 (on the cable insertion side) ride on upper edge portions of corresponding guide grooves 37 formed in the inner side surfaces of the terminal block 3 when the insulation displacement block 5 is inclined (at an inclination angle of $30^\circ - 40^\circ$) with respect to the hinge portion so that the inclination of the insulation displacement block 5 can be held.

If a predetermined strength of force is applied to the insulation displacement block 5 at a time of insulation displacement operation, the second projections 35 ride over the upper edge portion of the terminal block 3 and enter the guide groove 37 so as not to prevent the movement of the insulation displacement block 5 to a parallel position (described below).

The second projections 35 and the guide grooves 37 in which the projections 35 are inserted serve as a guide means for the downward translation (parallel movement) of the block 5. Note that the guide means could be practically ineffective in view of the slight (translational) displacement (i.e., the guide means is not necessarily indispensable).

The third front and upper projections 41 (on the connector connection side of the terminal block 3) and the fourth rear and upper projections 43 (on the cable

insertion side) which are both provided on the upper portions of both side faces of the insulation displacement block 5, and between the first projections 31 and the second projections 35 are constructed so that when the insulation displacement block 5 is moved to the parallel position, the third and fourth projections ride over the inner upper edge portions of the terminal block 3 to establish and keep the parallel state.

10 The third projections 41 and the fourth projections 43 are fitted in the corresponding recesses, i.e., first recesses 33 and second recesses 45, respectively, upon the pressure welding connection in which the insulation displacement block 5 is engaged in the terminal block 3. Consequently, the third and fourth projections are engaged by the upper portions of the recesses 33 and 45 to prevent the insulation displacement block 5 from being detached.

20 The operation and effect of the connector 1 constructed as above, according to the present invention will be described below.

Before the cables be connected are inserted in the insulation displacement block 5, the insulation displacement block 3 can be easily brought to and held in an inclined position (by 30° - 40°) relative to the terminal block 3. Therefore, the inserting cable operation can be extremely easily carried out (Fig. 9).

30 Upon insertion of cables, the cables are mechanically plugged into the circular holes 15 of the insulation displacement block 5 until the cables abut against the terminal block 3. Therefore, further insertion of the cables extending through the insulation displacement block 5 is not permitted.

Owing to this and to the transparency of the insulation displacement block 5, it can be easily recognized and confirmed whether the amount of the cable insertion amount is sufficient or not. Therefore, not only can
5 the burden on an operator be reduced, but also misoperation can be eliminated.

The cable engaging member 21 in the insulation displacement block 5 engages with each cable and prevents the cables from being slipped-off, thus
10 resulting in an extremely enhanced operability. As a result of the evaluation tests of a cable holding force, which have been conducted to numerically show the cable slip-off prevention effect, it has been found that the cable holding force (more than about 5g/Pin)
15 was considerably larger than that (0g/Pin) in the absence of the cable engaging member. This value satisfies the requirements (equal to or more than 3g/Pin).

Next, a small force applied to the insulation
20 displacement block 5 from above (by an operator) moves the same from the inclined position to a parallel position in which it is parallel with the terminal block 3. In this position, the third projections 41 and fourth projections 43 provided on the opposed side
25 faces of the insulation displacement block ride over both inner side faces of the terminal block 3, so that the insulation displacement block 5 is held in parallel with the terminal block 3 (Fig. 10).

Therefore, an operator simply exerts a mechanical
30 force from above and below on both the members 3 and 5 which are held in parallel, by use of a special nipping jig (not shown) for insulation displacement. As a result, the insulation displacement block 5 is

translated downward, and is snugly fitted in the terminal block 3 (Fig. 11).

Consequently, the insulation displacement portion 13 of the terminal 9 is insulation-displaced and connected to the cables, i.e., the insulation displacement portion 13 of the terminal 9 cuts the outer sheaths of the cables and establish and maintain an electrical connection with the cables. In addition, at this time, the third projections 41 and the fourth projections 43 of the insulation displacement block 5 are fitted in the recesses (first recesses 33 and second recesses 45) provided on both inner surfaces of the terminal block to establish a slip-off prevention state (structure).

In connection to a plurality of insulation displacement portions of the terminals 9 and a plurality of corresponding cables, since the terminals 9 are insulation-displaced to the cables across the latter in a direction perpendicular to the longitudinal direction thereof, core wires of cables (single wire or stranded wire) tend not to receive an excess force, thus resulting in no breakage of wires. Therefore, the safe and highly precise insulation displacement operation can be easily and rapidly effected. This operation is very practical and useful.

Here, if various cable engaging members 21 which are relatively low-priced and which are different in material and size (structure) are prepared, even if the specification (core wire diameter, etc.) of cables to be insulation-displaced is modified, the insulation displacement and connecting operation for modified cables can be carried out simply by the replacement of the cable engaging member 21 for the pressure block 5.

In other words, uneconomical and cumbersome operation and administration system, such as production and storage of a number of different insulation displacement blocks and terminal blocks for each cable
5 can be very reasonably and economically dispensed with.

Effect of the Invention

According to the present invention, as described above, not only can the cable insertion operation be
10 easily and rapidly carried out, but also it is possible to perform a reliable insulation displacement operation.

BRIEF DESCRIPTION OF THE DRAWINGS

15 FIG. 1 is a plan view of an embodiment of an insulation displacement connection type connector according to the present invention.

Fig. 2 is a left side view of a connector in Fig. 1
20

Fig. 3 is a right side view of a connector in Fig. 1.

Fig. 4 is an exploded perspective view of a connector.

25 Fig. 5 is a perspective view of a single insulation displacement block.

Fig. 6 is an exploded perspective view of an insulation displacement block.

30 Fig. 7 is a longitudinal sectional view of an insulation displacement block.

Fig. 8 is a view of a cable engaging member, in which (a) shows a left elevational view, (b) a plan view, (c) a right elevational view, (d) a side view, and (e) a side sectional view.

5

Fig. 9 is a perspective view showing an insulation displacement block hinged to a terminal block.

Fig. 10 is a perspective view of an insulation displacement block in parallel to a terminal block.

10

Fig. 11 is a perspective view of an insulation displacement block and a terminal block in an insulation displaced state.

15

Explanation of Reference Numerals

- 1 ... connector
- 3 ... terminal block
- 5 ... insulation displacement block
- 20 7 ... recess
- 9 ... terminal
- 11 ... cavity
- 13 ... insulation displacement part
- 15 ... circular opening
- 25 21 ... cable engaging member
- 25 ... corresponding recess
- 27 ... recess
- 31 ... first projection
- 33 ... first recess
- 30 35 ... second projection
- 37 ... guide groove
- 41 ... third projection
- 43 ... fourth projection

45 ... second recess

What is claimed is:

1. An insulation displacement connection type connector, including:

5

a terminal block for housing therein a plurality of terminals to which cables are insulation-displaced for electric conduction;

10

an insulation-displacement block having cable insertion holes for inserting cables, said pressure welding block being adapted to be set in a state parallel to said terminal block at a time of pressure welding of cables and to be moved close to said terminal block, in a translational movement manner;

15

inclination holding means for releasably holding said pressure welding block in a state inclined relative to said terminal block, to thereby facilitate insertion of said cables; and

20

parallelism holding means for releasably holding, upon releasing of said inclination holding means, said pressure welding block in a state parallel to said terminal block.

25

2. A connector of claim 1, wherein said inclination holding means includes a projection provided on either of said terminal block or said insulation-displacement block.

30

3. A connector of claim 1, wherein said

parallelism holding means includes a projection provided on either of said terminal block or said insulation displacement block.

5 4. A connector of claim 1, further comprising cable engaging means which is detachably mounted.

 5. A method for insulation displacement in an insulation displacement connection type connector,
10 including: a terminal block for housing therein a plurality of terminals to which cables are pressure welded for electric conduction; and a insulation displacement block having cable insertion holes for
15 inserting cables, the pressure welding block being adapted to be set in a state parallel to the terminal block at a time of pressure welding of cables and to be moved close to the terminal block, in a translational movement manner; comprising the steps of:

20 holding the insulation displacement block in a state inclined relative to the terminal block, making use of inclination holding means;

 inserting cables into cable insertion
25 holes of the insulation displacement block;

 holding the insulation displacement block in a state parallel to the terminal block, making use of parallelism holding means; and

30 conducting a pressure welding operation by moving the insulation displacement block relatively close to the terminal block, in a translational

movement manner.

Fig. 1

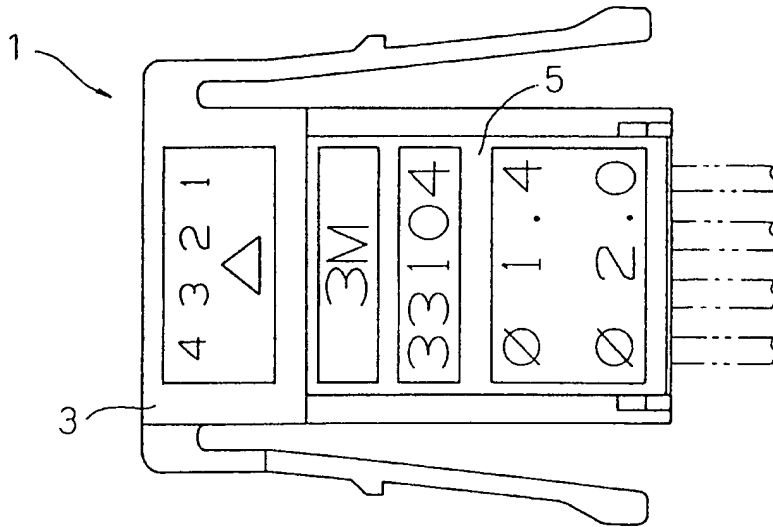


Fig. 2

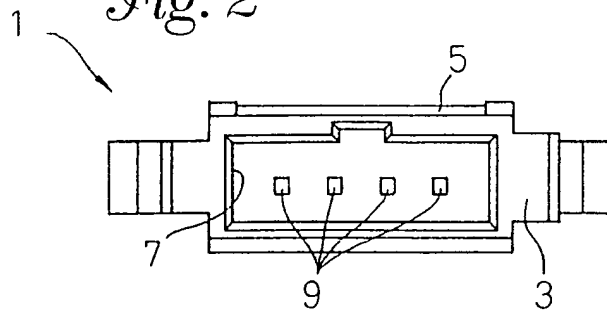


Fig. 3

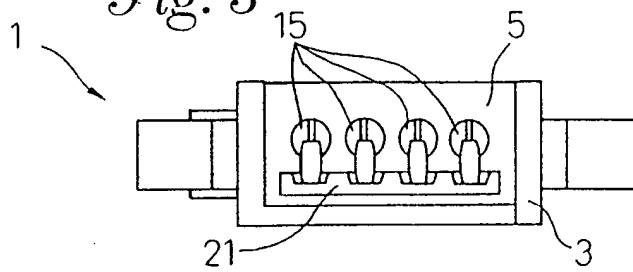


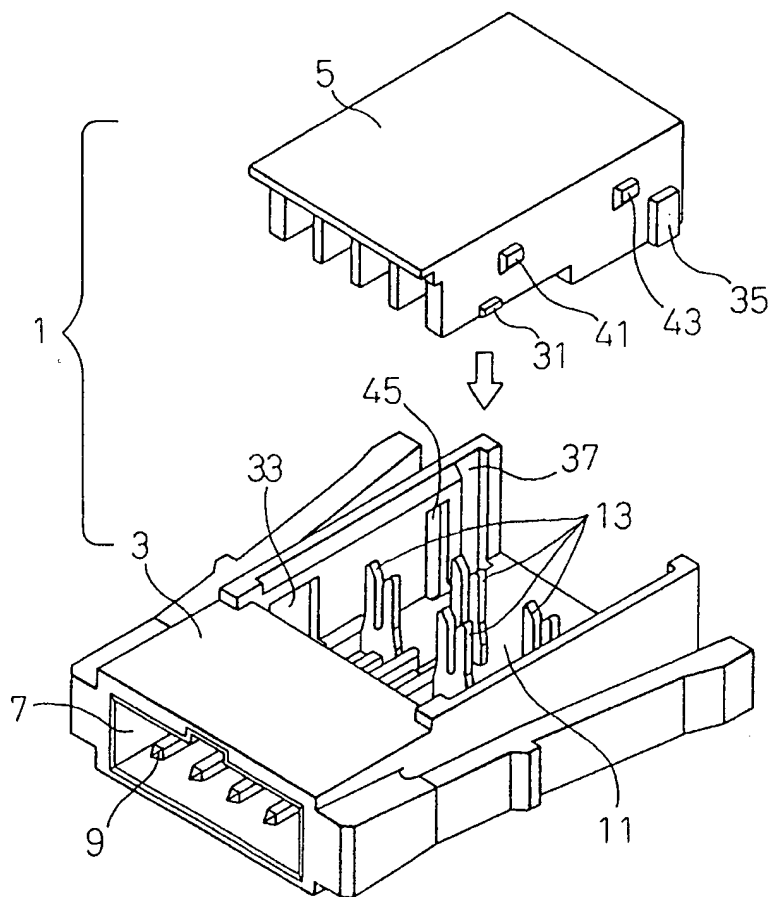
Fig. 4

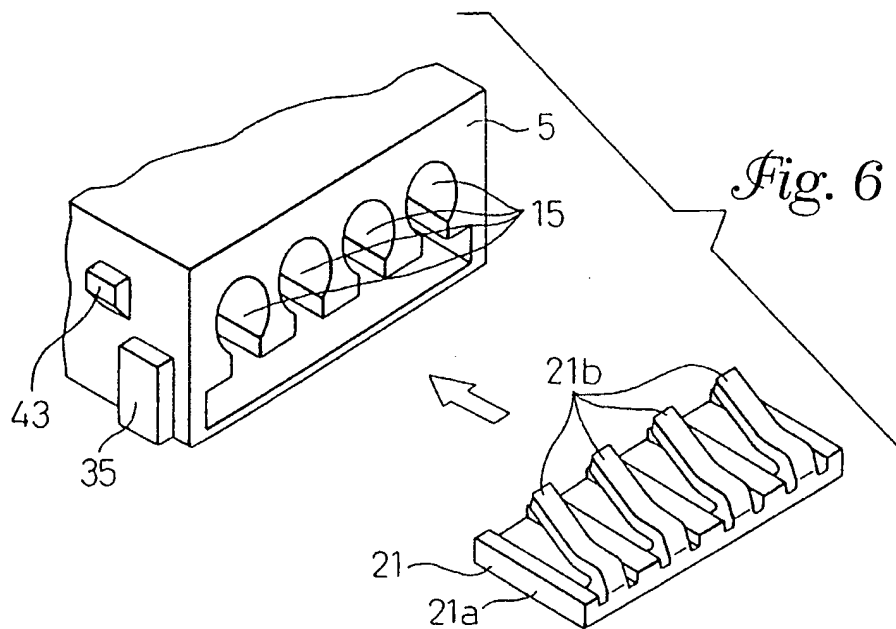
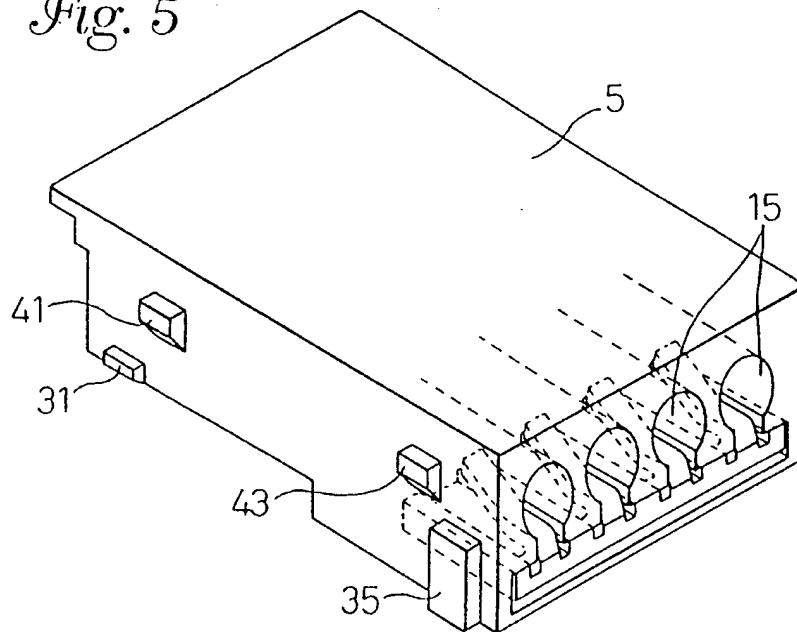
Fig. 5

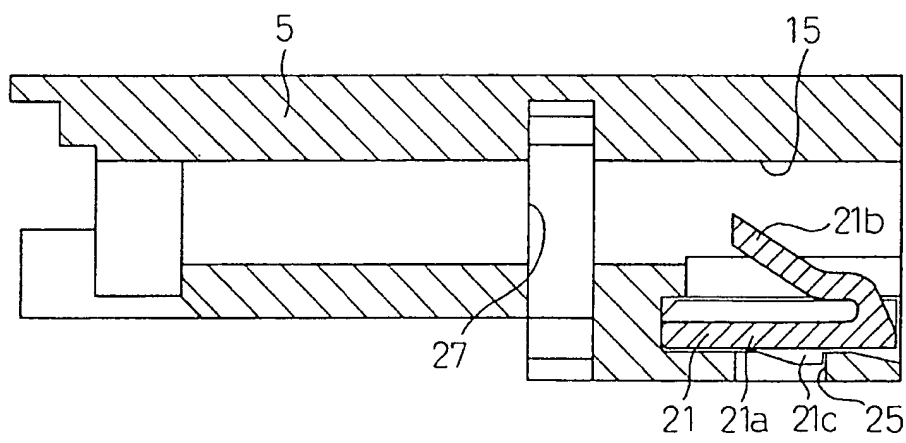
Fig. 7

Fig. 8a

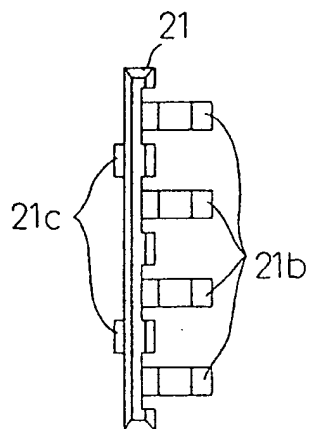


Fig. 8b

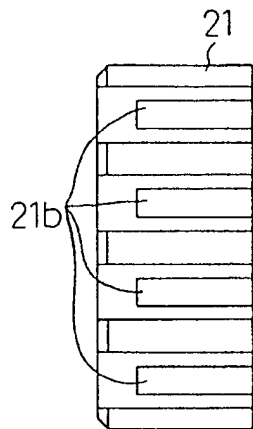


Fig. 8c

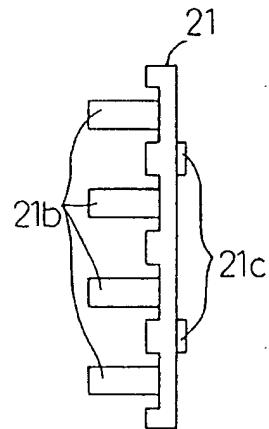


Fig. 8d

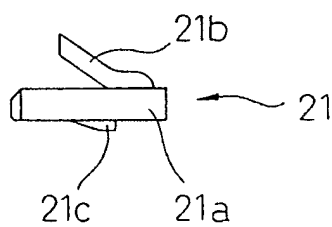


Fig. 8e

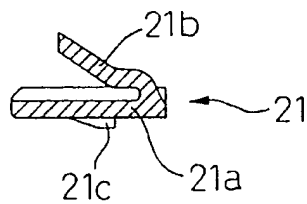


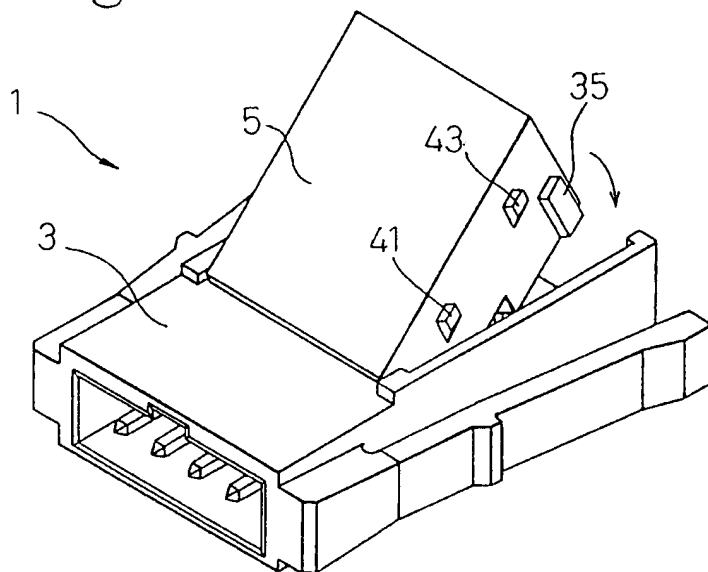
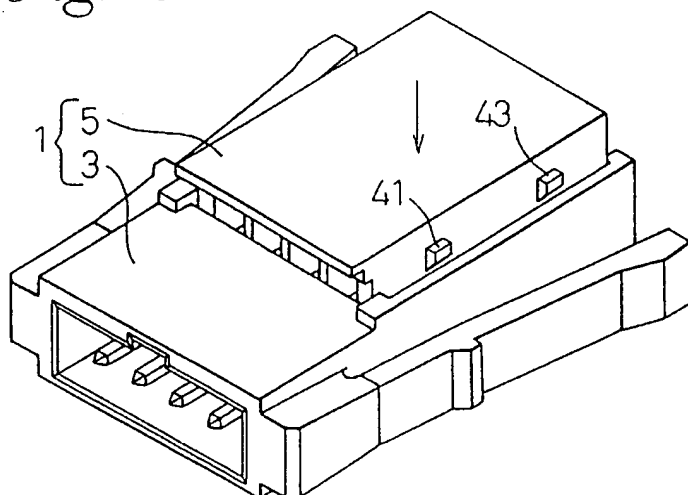
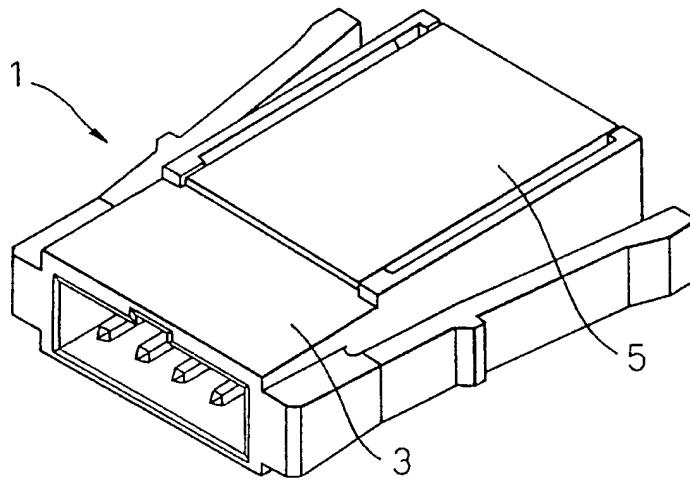
Fig. 9*Fig. 10*

Fig. 11

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/11535

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H01R4/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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| A | WO 91 05377 A (RAYCHEM CORP) 18 April 1991 (1991-04-18) abstract; figure 2A page 7, line 33 -page 9, line 35 --- | 1,5 |
| A | US 3 899 236 A (SANTOS ANTHONY J) 12 August 1975 (1975-08-12) abstract; figures 3-5 column 3, line 63 -column 5, line 30 --- | 1,5 |
| A | EP 0 122 373 A (GROTE & HARTMANN) 24 October 1984 (1984-10-24) abstract; figures 2,5 page 3, line 13 -page 4, line 28 page 7, line 17 -page 8, line 3 --- -/-- | 1,4,5 |

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

21 September 1999

Date of mailing of the international search report

28/09/1999

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

International Application No

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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